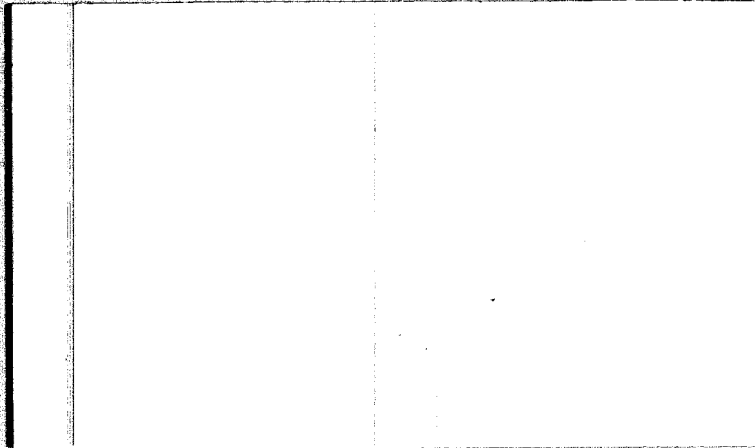


Howie 453

CONFIDENTIAL

Rec'd EB  
3/13/61

3



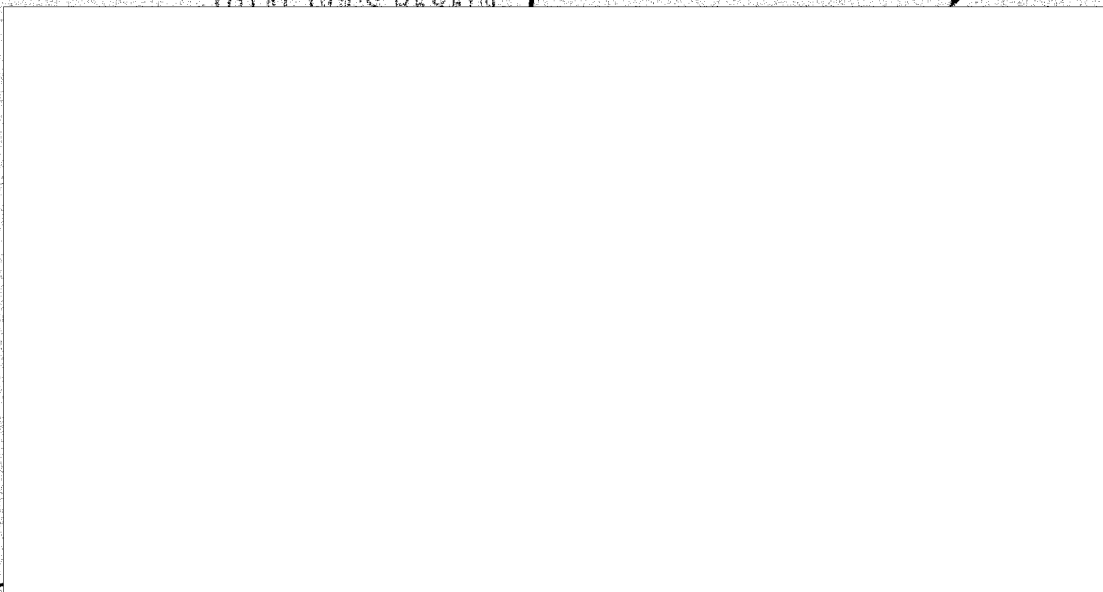
JOB NO. 78-03639A

BOX NO. 16

FOLDER NO. 3

TOTAL DOCS HEREIN 1

25X1



231614/2

231614/2

CONFIDENTIAL

CACHING, UNDERWATER 177A  
STORAGE CONTAINER

I RESULTS OF INSPECTION OF SEA-WATER-IMMERSED  
AND UNDERGROUND-BURIED CONTAINERS AND  
SPECIMENS - CONDUCTED MAY 27-30, 1958

Final Report  
CONFIDENTIAL

DOC	REV	DATE	BY
ORIG COMP		ORI	103
ORIG CLASS	4	19	1030
JUST			

CONFIDENTIAL

25X1

March 6, 1961

CONFIDENTIAL

Dear Sir:

This letter report describes the results of the inspection conducted on May 27-30, 1958, on the 7" x 9" x 16" stainless steel containers covered with four different kinds of coatings, the special painted aluminum-balsa wood containers, and the experimental aluminum-alloy container-type specimens coated with the Amercoat AC system. The first two types of containers had been exposed to shallow sea-water immersion and to underground burial, and the experimental container-type specimens, to underground burial, for 8 months.

The results of the inspection are presented in three appendixes, identified as follows:

- Appendix 1. Inspection of 7" x 9" x 16" Stainless Steel Containers Covered With Various Coatings, After Sea-Water Immersion and Underground Burial
- Appendix 2. Inspection of Special (Aluminum-Balsa Wood) Painted Containers After Sea-Water Immersion and Underground Burial
- Appendix 3. Inspection of Experimental Aluminum-Alloy Container-Type Specimens After Underground Burial

We would appreciate any comments which you or your associates might care to make with regard to the inspection results.

Sincerely,

25X1

ABW:sjm

In Duplicate

CONFIDENTIAL

APPENDIX 1

INSPECTION OF 7" x 9" x 16" STAINLESS STEEL  
CONTAINERS COVERED WITH VARIOUS COATINGS,  
AFTER SEA-WATER IMMERSION AND UNDERGROUND BURIAL

Sixteen containers, which had been provided by the Sponsor in the as-coated condition, i.e., four each covered with four different kinds of coatings, had been exposed to shallow sea-water immersion and to underground burial on October 2 and 4, 1957, respectively. The sea-water immersion had been achieved by attaching the containers to the floating dock. The depth of immersion was 18". Some of the containers had been buried on their sides in a trench which was about 2 ft deep. At the time of burial, standing water had been present in the trench; at the time of this inspection, the soil at burial depth was quite wet, but no standing water was evident.

A sample of soil at the burial depth was taken and subsequently sent to  Corrosion Section, National Bureau of Standards, Washington, D. C., at the Sponsor's suggestion. This sample consisted of about equal parts of black topsoil and white or gray marl.

25X1

The results of the inspection of four containers after 8 months of sea-water exposure and of four containers after 8 months of underground burial are presented below.

General Summary

On the basis of the results of 8 months of exposure, it appears that the vinyl and Hypalon coatings used are not suitable for the protection of these stainless steel containers in sea water or underground; these coatings rapidly lost adhesion and peeled or blistered. Deterioration of these coatings under soil-burial conditions appeared to be occurring at a

-2-

slightly slower rate, probably because of the less severe conditions represented by the soil.

However, the epon-urea and neoprene coatings used show considerable promise in this application for sea-water or underground-burial exposure. After 8 months of exposure, these coatings were quite adherent and appeared to be providing good corrosion protection.

Detailed Inspection Notes on Immersed Containers

Container No. 16 (With Epon-Urea Coating)

Only the exterior was inspected.

Moderate to heavy fouling was noted. This consisted mainly of barnacles, up to 3/4" in diameter, and oysters, up to 1-1/2" in diameter.

The coating appeared to be in excellent condition throughout, except for two areas 1/4" and 1/2" in diameter on the lower end, at the joint between the end section and the side or the main body of the can. In these areas, there was deep pitting at the joint, although the container was apparently not yet perforated. No other evidence of corrosion was found on the container. These areas were indicated by the presence of a reddish rust stain showing through the thin fouling accumulation present at those areas.

The container was replaced on exposure.

Container No. 19 (With Neoprene Coating)

Only the exterior was inspected.

Moderate to heavy fouling was noted. This consisted mainly of barnacles, up to 3/4" in diameter, and oysters, up to 1-1/2" in diameter.

-3-

The coating appeared to be in excellent condition, with the exception of two points on the lid, at the overhanging lip by which the latch is attached to the lid. At these points, the presence of red rust stain showing through the fouling indicated some corrosion of the underlying metal, although there was no evidence of deep penetration at these points.

The container was replaced on exposure.

Container No. 4 (With Vinyl Coating)

Moderate to heavy fouling was noted. This consisted mainly of barnacles, up to  $3/4$ " in diameter, and oysters, up to  $1-1/2$ " in diameter.

When shaken, the can seemed to contain water; when opened, the can was found to be about  $1/2$  full of water. Deep corrosion attack was noted on the outer portion of the lid, and after some probing was done, was found to have penetrated entirely through the metal, in an area about  $3/8$ " in diameter. This point of penetration was directly over the center of the gasket at one corner of the lid, and was the direct route of water entry into the container. The ballast steel below the level of the water in the can was covered with a soft, black material, approximately  $1/32$ " thick, which resembled that found on the bolts in the aluminum-balsa wood Container No. 2. (See Appendix 2.) On the exterior of the container, the coating was peeled to the metal over 90% or more of the surface; this verified previous observations as to the lack of adhesion of the vinyl coating.

The container was stored at the NFRS.

-4-

Container No. 8 (With Hypalon Coating)

Moderate to heavy fouling was noted. This consisted mainly of barnacles, up to 3/4" in diameter, and oysters, up to 1-1/2" in diameter.

The coating was lost over approximately 95% of the surface and the remaining coating peeled on removal of the fouling. The exterior of the container showed a few spots of shallow corrosion attack on the corners. On opening of the container, water to a depth of about 1/2" was found. Further examination showed that this water had entered through a pinpoint perforation in the weld bead, about 2" below the top of the can body. Deep corrosion and perforation were also found on the lid latch and at one point on the lid itself, although this perforation did not appear to have permitted water entry.

The container was stored at the NFRS.

Detailed Inspection Notes on Underground-Buried Containers

Container No. 5 (With Epon-Urea Coating)

Except where mechanically damaged on the lid (an area 1/2 x 1"), the coating was in excellent condition. The color was essentially unchanged, and no loss of adhesion was evident at the abraded area.

Numerous pinpoint to 1/8"-diameter blisters were noted in the coating, adjacent to the lip of the can body. This container was opened because during handling, water was heard sloshing around. About 1 pt of water was found in the can. No explanation of the leakage was apparent.

The container was removed from test, and taken by the Sponsor.

-5-

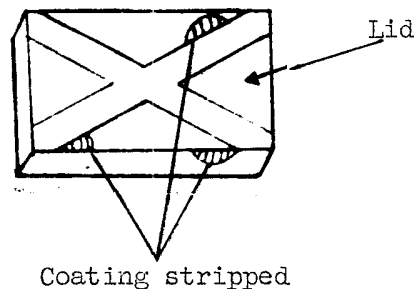
Container No. 8 (With Neoprene Coating)

The coating was in excellent condition, except where it was peeled to the metal in a  $3/8$ "-diameter area on the lid during removal (mechanical damage) and scratched lightly on one broad side by the shovel. The adhesion appeared to be very good. The coating could not be peeled readily.

This container was not opened; it was replaced on exposure.

Container No. 7 (With Vinyl Coating)

Numerous blisters,  $1/8$  to  $1/2$ " in diameter, were noted throughout; they were partially water filled. The coating adhesion was very poor. The coating could be stripped from the metal with little difficulty; the coating was peeled at three places during the examination, as shown:



This container was not opened; it was replaced on exposure.

Container No. 6 (With Hypalon Coating)

Many small blisters,  $1/16$  to  $1/8$ " in diameter, were noted; most of them were broken and collapsed. The coating felt rubbery; the adhesion was very poor. The coating could readily be peeled from the can at any



-6-

point; one 1"-diameter area on the lid and one 3/4"-diameter area on the wide side 2" below the lid were peeled in the examination.

This container was not opened; it was replaced on exposure.

-7-

APPENDIX 2

INSPECTION OF SPECIAL (ALUMINUM-BALSA WOOD)  
PAINTED CONTAINERS AFTER SEA-WATER IMMERSION  
AND UNDERGROUND BURIAL

Three of these containers had been immersed in shallow sea water on October 2, 1957, and three had been buried underground on October 4, 1957, in the same manner as were the 7" x 9" x 16" stainless steel containers, as described in Appendix 1. The containers had been provided by the Sponsor. The results of the inspection conducted on some of these containers after 8 months of exposure are presented in the following.

General Summary

This type of container appears to be unsatisfactory for sea-water-immersion service, possibly because of the inadequacy of the seal between the lid and the body. The coating used on these containers was in good condition; this system might be of potential interest for application on other aluminum or aluminum-alloy items for sea-water service.

The containers buried underground were in satisfactory condition after 8 months of exposure.

Detailed Inspection Notes

Sea-Water-Immersed Containers

All three of the containers (arbitrarily identified as Nos. 1, 2, and 3) were retrieved from the float and examined. The fouling was moderate

-8-

to heavy, and consisted mostly of barnacles, up to 3/4" in diameter, and oysters up to 1-1/2" in diameter.

To check cursorily for the presence of water, each of the containers was shaken and attempts were made to pick up audible indications of water sloshing. Only one container, No. 2, appeared to have taken in water. This was opened, and found to be almost filled with water. Most of the water had apparently entered through the "seal" between the lid and the rubber gasket; also, there was evidence that the water had penetrated at two small areas between the gasket and the top of the can body.

There was considerable evidence of corrosion on the interior of the can; this was mostly confined to the upper 1" of the container body. In these areas, considerable, uniform corrosion attack had occurred over the surface, but no perforation of the metal was evident. The interior of the can lid was also etched extensively over about 90% of the surface area. A considerable amount of white gelatinous corrosion product was present as a result of corrosion attack on the aluminum at the top of the can.

After a transverse cut was made through the container at about 1-1/4" below the top, it was found that the corrosion attack had penetrated behind the interior aluminum lining. This was evidenced by the presence of corrosion product between the balsa-wood stiffening member and the interior lining.

Before the original exposure of Container No. 2, six large metal bolts about 1" in diameter had been inserted. In this inspection, these were found to be uniformly covered with a black or grayish-black deposit up to 1/16" thick. The nature of this deposit was not readily identified

-9-

because it was not known whether the bolts had been coated prior to being inserted in the can. The deposit could be removed readily with a scraper, leaving bright metal underneath. The metal surface was slightly roughened and showed what appeared to be etching. If desired, this could be checked by determining whether the bolts were machined prior to being inserted in the container; if so, it appears that considerable corrosion attack on the bolts may have occurred during this 8-month exposure.

The condition of the paint on the exterior of Container No. 2 was fair. It was abraded or peeled to the metal or to the primer in a number of spots, apparently due to mechanical damage. Additional peeling occurred when part of the fouling was removed. However, the adhesion of the remaining coating appeared to be satisfactory. No evidence of corrosion was found on either the bands used to seal the can or on the exterior of the can body. Container No. 2 was subsequently destroyed.

Containers Nos. 1 and 3 were not opened, and were replaced on exposure.

#### Underground-Buried Container

Only one container was retrieved for examination. This had arbitrarily been identified as No. 9.

The paint was peeled to the metal in many areas, pinpoint to 1/32" in diameter, on the lid and upper part of the body. Elsewhere, numerous pinpoint-size blisters had formed, and most of these were broken and collapsed. Except in those areas where blistering had occurred, the adhesion of the coating appeared to be good. Some of this blistering involved only the top layer(s) of the coating; the primer appeared to be adhering.

-10-

(The weight of the desiccant which had been inserted in this container prior to exposure was 140.4 g.)

This container was not opened; it was replaced on exposure.

-11-

APPENDIX 3INSPECTION OF EXPERIMENTAL PAINTED  
ALUMINUM-ALLOY CONTAINER-TYPE SPECIMENS  
AFTER UNDERGROUND BURIAL

Two experimental aluminum-alloy container-type specimens, prepared previously, had been buried underground on October 4, 1957, in the manner described in Appendix 1. These containers had been prepared using wrought aluminum alloy for the sides and bottom, cast aluminum alloy for the top and lid, and aluminum-alloy welding rod to join the bottom, sides, and top; a rubber O-ring seal had been provided as part of the lid. One of the exposed containers had been anodized and sealed; the other had been anodized and painted with an Amercoat AC system. The results of the 8-month inspection are presented below.

General Summary

After 8 months of exposure to soil conditions, the Amercoat AC coating was beginning to fail by blistering and peeling. The aluminum alloys used in these containers were all showing some signs of corrosion attack.

Detailed Inspection NotesSpecimen No. 4 (With Amercoat AC Coating)

Numerous blisters, 1/16 to 5/16" in diameter, were noted and these were partially water filled. The paint adhesion was poor; the coating could be stripped to the metal with little difficulty. The coating was peeled to

-12-

the metal in a 1-1/2"-diameter area on one side and in one 1/8"-diameter area on the lid to permit examination. There was no evidence of corrosion under the blisters, other than a very faint dark discoloration of the metal. The container was not opened.

The container was replaced on exposure.

Specimen No. 3 (Anodized and Sealed)

The sides and bottom showed at least 8 spots of deep pitting, 1/64 to 1/32" deep; these areas were 1/16 to 1/8" in diameter. (These areas were circled by blue wax crayon after inspection.) On the top, one 3/16"-diameter spot of shallow etching was noted along one edge (marked with crayon). Possible traces of pinpoint pitting were observed elsewhere. The lid exhibited traces of very shallow pinpoint pitting, and the weld metal, several spots of deep pitting, 1/32+" deep. The container was not opened.

The container was replaced on exposure.